**Symposium Title**: Impacts of lifestyle factors on cognitive outcomes in adults with intellectual and developmental disabilities: insights for intervention strategies

**Chair**: Amy E. Bodde[[1]](#footnote-1)

**Discussant**: Amy E. Bodde1

**Overview**: In the general population, modifiable risk factors including physical activity, physical function, cardiometabolic disease, and obesity are associated with 45% of all cases of dementia (1-3). However, limited research has examined these associations in individuals with intellectual and developmental disabilities (IDD). Research exploring relationships between these modifiable lifestyle factors and cognition are essential to inform health promoting interventions in this population, especially since fewer than 10% of individuals with IDD meet public health recommendations for physical activity (4) and 40-55% experience obesity and related cardiometabolic diseases (5, 6). This symposium will present intervention strategies aimed at enhancing physical activity and cognition among individuals with IDD and will explore lifestyle factors associated with cognitive decline, particularly in people with Down syndrome. Researchers from the University of Kansas Medical Center will share findings from a randomized controlled trial assessing cognitive outcomes of a physical activity intervention in adults with Down syndrome. Research from the University of Delaware will discuss how understanding the unique cognitive characteristics of Autistic adults can inform the design of new exergames to promote physical activity. The research team from St. Louis University will examine how physical and daily functioning relate to dementia risk symptoms in 43 adults with Down syndrome. Finally, findings from a longitudinal trial at the University of Wisconsin will demonstrate how weight loss trajectories in older adults with Down syndrome correlate with cognitive decline and amyloid-beta pathology.

**Paper 1 of 4**

**Paper Title**: **Improvements in Cognition Across a 12 Month Randomized Exercise Intervention in Adults with Down Syndrome**

**Authors**: Lauren T Ptomey1,Brian C Helsel[[2]](#footnote-2),Rik A Washburn1, Jessica C Danon1,Joseph R Sherman1, Robert N Montgomery[[3]](#footnote-3), Daniel Forsha[[4]](#footnote-4), Amy E Bodde1, Amanda N Szabo-Reed1, Anna M Gorczyca1, Joseph E Donnelly1

**Introduction**: Evidence in adults without Down syndrome (DS) suggests that exercise during mid-life improves cognitive function and decreases risk of later life dementia. Studies supporting this relationship in adults with DS are limited. This study aimed to assess the feasibility and potential effectiveness of a 12-month remotely delivered group exercise intervention at two different frequencies (1x/week and 3x/week) in increasing cognition among adults with DS, compared to a usual care control group.

**Method**: Adults with DS were randomized (2:2:1) into three groups: a low-frequency exercise group (1 session/week, RL), a high-frequency group (3 sessions/week, RH), and a health coach-only group (HCO), which did not participate in exercise sessions. All groups were provided with a physical activity tracker, resources to encourage exercise, and twice-monthly 20-minute individual support sessions delivered remotely. Each exercise session, delivered to groups of ~8 participants, consisted of approximately 30 mins. of moderate to vigorous physical activity (MVPA). Physical activity (accelerometry) was assessed across 12 mos. Cognitive function was assessed at baseline, 6, and 12 months, using the CANTAB® DS Battery, which included tests measuring multitasking, episodic memory, and reaction time. Linear mixed-effects analyses were used to test the effect of the intervention on changes in cognitive function, controlling for age, sex, and level of intellectual disability.

**Results**: Adults with DS (n=81, ~ 27 yrs. of age, 55% female) were randomized to the RH (n=34), RL (n=32) and HCO (n=15) arms. Retention at 12 months was 100%. Attendance to the remote exercise sessions was 90% and 79% in the RH and RL arms respectively. There were no reported serious adverse events. MVPA was similar at baseline in all intervention arms (RH = 14 ± 14 mins. /day, RL = 18 ± 30 mins./day, HCO = 16 ± 16 mins./day). Across 12 months, the RH arm demonstrated a 10 min/day increase in MVPA, while changes were minimal in the RL (+2 mins. /day) and HCO (+1 mins./day) arms.  Across all groups episodic memory (p = 0.018), 5-choice movement time (p = 0.017), and 5-choice reaction time (p = 0.022) improved across the intervention, however, there were no group x time effects.

**Discussion**: The findings suggest that delivering remote group exercise sessions is both feasible and potentially effective for increasing daily MVPA and cognitive function in adults with DS over 12 months. Future adequately powered trials are warranted to examine the impact of long-term exercise on cognition function outcomes compared to a non-exercise control.

**References:** Please see end of document.

**Paper 2 of 4**

**Paper Title: Predicting Gaming Disorder Through 24-Hour Movement Behaviors in Autistic Adults: Implications for Strength-Based Intervention Designs for Physical Activity Promotion**

**Authors**: Lia K. McNulty[[5]](#footnote-5), Swetha Kathiravan5, Daehyoung “DH” Lee5

**Introduction**: Autistic adults often display a greater susceptibility to excessive gaming behaviors due to their natural predilection for digital gaming and distinct strength in visuospatial learning. This affinity for gaming may negatively impact 24-hour movement behaviors, including physical activity (PA), sedentary behavior (SB), and sleep, in autistic adults, who already tend to be insufficiently active due to unique individual and environmental barriers, such as high sensory sensitivities and low intrinsic motivation for exercise. The aims of this study were to (1) identify the prevalence of gaming disorder and characteristics of 24-hour movement behaviors and (2) assess the relationship between gaming behavior, PA, SB, and sleep quality in autistic adults, including those with co-occurring mild intellectual disabilities (ID).

**Method**: An online, self-report survey was developed using standardized instruments to assess demographic information, gaming behavior(7), PA,(8) SB(9), and sleep(10) in autistic adults. The survey was reviewed for content validity and took approximately 15 minutes to complete. Participants were recruited with the assistance from the Simons Foundation Powering Autism Research for Knowledge (SPARK) Research Match services. The inclusion criteria were: adults (1) aged 18 to 55 years, (2) formally diagnosed with an autism spectrum disorder by a medical professional or self-identifying as autistic, and (3) able to walk and process information independently without substantial support from assistive devices or others. Descriptive statistics were used to summarize demographic characteristics and patterns in the preventive health behaviors. Pearson correlation and stepwise multiple regression analyses were performed to examine the relationship between gaming behavior, PA, sedentary time, and sleep quality, as well as other demographic variables. Multicollinearity was not observed in regression models. SPSS v29.0 (IBM Corp., NY, USA) was used to analyze the data.

**Results**: Forty-six autistic adults (Mage 33.3±10.3**;** 80% females; 43.5% with mild ID) completed the survey. Autistic adults spent 625.8±910.3 min/week for video or online gaming, 86.9±102.0 min/week for moderate PA and 39.8±73.4 min/week for vigorous PA engagement. Sedentary time was relatively higher on weekend (583.0±304.2 min/day) compared to weekday (573.3±271.5 min/day). 15.2% of the participants were identified as potentially having a gaming disorder while 39.1% of the participants showed poor quality of sleep. The total gaming disorder score was significantly associated with total gaming time (*r* =.43, *p* =.003), vigorous PA (*r* =−.30, *p* =.042), weekday sedentary time (*r* =.59, *p* <.001), and weekend sedentary time (*r* =.37, *p* =.011). Stepwise multiple regression models revealed that weekday sedentary time, total gaming time, and vigorous PA significantly predicted the severity of gaming disorder, *F*(3, 42) = 15.192, *p* <.001, *R2* =.52.

**Discussion**: The preliminary findings of this study align with previous research, indicating that autistic adults may be more susceptible to excessive gaming behaviors. Although no significant association was found between gaming behavior and sleep quality, gaming was negatively correlated with increased sedentary time and reduced engagement in vigorous PA. These results suggest that gaming behaviors may contribute to sedentary lifestyles, underscoring the need for targeted interventions that promote healthy 24-hour movement behaviors among autistic adults. Leveraging these insights, a game-based mobile health intervention has been developed to increase PA and reduce SB in this population. This innovative behavior change intervention employs a strengths-based, gamified approach to effectively engage the interests and cognitive strengths of autistic adults, aiming to help these individuals meet the recommended 24-hour movement guidelines for health promotion across the lifespan.

**References:** Please see end of document.

**Paper 3 of 4**

**Paper Title: Dementia risk symptoms and functional activity in adults with Down syndrome**

**Authors**: Selena Washington[[6]](#footnote-6), Amy E Bodde1, Brian C Helsel2, Rebecca M Bollinger[[7]](#footnote-7), Nora Smith6, Lauren T. Ptomey1, Beau Ances7, Susan L. Stark6

**Introduction**: Adults with Down syndrome (DS) are at a higher risk of developing Alzheimer's disease (AD) dementia, often showing neuropathological indicators by age 40(11). This study looked at the understudied associations between age, physical function (including walking/balance, grip strength, and lower body strength), activities of daily living (ADLs), and dementia risk symptoms in adults with DS. We predicted that poorer physical function and lower independence with ADLs would be linked to higher dementia risk scores.

**Method**: This cross-sectional study used secondary data from two academic research centers, involving 43 adults with DS (average age 30 ± 12 years). We analyzed the relationship between dementia risk symptoms, measured by the Dementia Screening Questionnaire for Individuals with Intellectual Disabilities (DSQIID)(12), with physical function (timed up and go [TUG], sit-to-stand [STS], and grip strength) and ADLs (Waisman Activities of Daily Living Scale(13)). To handle the high number of zero scores in the dementia risk data, a log transformation (1 + log(Y + 1)) was applied to the continuous DSQIID measure. Wilcoxon rank-sum tests were used to examine differences in physical function, DSQIID scores, and ADLs across age groups.

**Results**: Higher DSQIID scores, indicating greater dementia risk, were linked to lower independence in ADLs (β = −0.103, p = 0.008), slower walking times (TUG; β = 0.112, p = 0.034), weaker lower body strength (STS; β = 0.112, p = 0.017), and reduced grip strength (β = −0.039, p = 0.034). Significant differences in DSQIID scores were found between adults aged ≥30 and those under 30, with the older group scoring 5 points higher, indicating increased dementia risk with age.

**Discussion**: Increased dementia risk symptoms were associated with older age, lower physical function, and reduced independence in ADLs. These findings suggest that declines in physical function and ADL performance may serve as early signs of dementia risk in adults with DS.

**References:** Please see end of document.

**Paper 4 of 4**

**Paper Title**: Timing of weight change and Alzheimer’s disease in adults with Down syndrome

**Authors**: Victoria L. Fleming[[8]](#footnote-8), Brian C. Helsel2, Jamie Peven[[9]](#footnote-9), Lauren T. Ptomey1, Benjamin Handen9, Ozioma Okonkwo8, Sigan Hartley8, and the Alzheimers Biomarker Consortium – Down Syndrome

**Introduction:** Adults with Down syndrome (DS) are genetically predisposed to Alzheimer’s disease (AD) due to the triplication of chromosome 21 (14). AD pathology, including amyloid-beta (Aβ) plaques and tau accumulation, is typically evident in neuroimaging biomarkers in adults with DS by their 30s and 40s (15). Cross-sectional research has demonstrated that from the mid to late 30s, body mass index (BMI) decreases by approximately 0.23 kg/m² per year in adults with DS (16). Building on this finding, the present study leveraged longitudinal data across three collection cycles (spanning 32 months) to examine whether BMI decline is part of the AD progression in persons with DS and how it relates to baseline AD pathology and cognitive declines over the same period.

Method: The study included 245 adults with DS (aged 25-81) from the Alzheimer Biomarker Consortium-Down Syndrome (ABC-DS) who participated in up to three data collection cycles spaced 16 months apart. BMI was calculated using height and weight. Cognition was assessed via both direct and informant-based measures of mental status, visuospatial ability, and memory. AD pathology was assessed using PET imaging biomarkers of Aβ and tau. Mixed linear models were conducted using the lmer package in R studio and controlled for age, sex, APOE allele 4 status, site, and premorbid intellectual disability level.

Results: Linear mixed models revealed a significant interaction between time and age on BMI (β = -0.015, p = 0.001). Younger adults with DS showed increases in BMI over the three time points, while older adults experienced BMI declines. In models including PET biomarkers, a significant interaction between baseline Aβ and time (β = -0.011, p = 0.023) indicated that adults with higher baseline Aβ had greater BMI declines over time compared to those with lower baseline Aβ. Baseline tau PET was not significantly associated with BMI change (β = -0.802, p = 0.873). Lower baseline scores on Block Design were associated with greater BMI declines across time (β = 0.04, p = 0.012), and greater cognitive decline on the DLD (β = -0.02, p = 0.005) and NTG (β = -0.021, p = 0.006) measures also predicted greater BMI reductions.

Discussion: Our results suggest that weight change is predicted by Aβ burden and corresponds with AD-related cognitive decline in adults with DS. Thus, weight loss may be an important sign of the impending transition to AD dementia in adults with DS. Weight loss should be included on screening measures of AD in persons with DS and addressed in dementia care management programs for this population. Understanding the mechanisms driving the interplay between weight change and AD in persons with DS is important for identifying intervention targets.

**References**

1. Jin Y, Liang J, Hong C, Liang R, Luo Y. Cardiometabolic multimorbidity, lifestyle behaviours, and cognitive function: a multicohort study. Lancet Healthy Longev. 2023;4(6):e265-e73.

2. Guo Y, Yang M, Yan Y, Wang L, Gong J. Sex differentials in relationships between functional fitness and cognitive performance in older adults: a canonical correlation analysis. Sci Rep. 2018;8(1):4146.

3. Livingston G, Huntley J, Liu KY, Costafreda SG, Selbæk G, Alladi S, et al. Dementia prevention, intervention, and care: 2024 report of the <em>Lancet</em> standing Commission. The Lancet. 2024;404(10452):572-628.

4. Dairo YM, Collett J, Dawes H, Oskrochi GR. Physical activity levels in adults with intellectual disabilities: A systematic review. Prev Med Rep. 2016;4:209-19.

5. Dodd D, Helsel B, Bodde AE, Danon JC, Sherman JR, Donnelly JE, et al. The Association of increased Body Mass Index on Cardiorespiratory Fitness, Physical Activity, and Cognition in adults with Down Syndrome. Disability and Health Journal. 2023:101497.

6. Ptomey LT, Walpitage DL, Mohseni M, Dreyer Gillette ML, Davis AM, Forseth B, et al. Weight status and associated comorbidities in children and adults with Down syndrome, autism spectrum disorder and intellectual and developmental disabilities. J Intellect Disabil Res. 2020;64(9):725-37.

7. Király O, Sleczka P, Pontes HM, Urbán R, Griffiths MD, Demetrovics Z. Validation of the Ten-Item Internet Gaming Disorder Test (IGDT-10) and evaluation of the nine DSM-5 Internet Gaming Disorder criteria. Addict Behav. 2017;64:253-60.

8. CDC. National Health and Nutrition Examination Survey: Physical Activity PAQ\_I [Available from: <https://wwwn.cdc.gov/Nchs/Nhanes/2015-2016/PAQ_I.htm>.

9. Rosenberg DE, Norman GJ, Wagner N, Patrick K, Calfas KJ, Sallis JF. Reliability and validity of the Sedentary Behavior Questionnaire (SBQ) for adults. J Phys Act Health. 2010;7(6):697-705.

10. Buysse DJ, Reynolds CF, 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Res. 1989;28(2):193-213.

11. Lott IT, Head E. Dementia in Down syndrome: unique insights for Alzheimer disease research. Nat Rev Neurol. 2019;15(3):135-47.

12. Deb S, Hare M, Prior L, Bhaumik S. Dementia screening questionnaire for individuals with intellectual disabilities. Br J Psychiatry. 2007;190:440-4.

13. Maenner MJ, Smith LE, Hong J, Makuch R, Greenberg JS, Mailick MR. Evaluation of an activities of daily living scale for adolescents and adults with developmental disabilities. Disabil Health J. 2013;6(1):8-17.

14. Fortea J, Vilaplana E, Carmona-Iragui M, Benejam B, Videla L, Barroeta I, et al. Clinical and biomarker changes of Alzheimer's disease in adults with Down syndrome: a cross-sectional study. Lancet. 2020;395(10242):1988-97.

15. Fortea J, Zaman SH, Hartley S, Rafii MS, Head E, Carmona-Iragui M. Alzheimer's disease associated with Down syndrome: a genetic form of dementia. Lancet Neurol. 2021;20(11):930-42.

16. Fleming V, Helsel BC, Ptomey LT, Rosas HD, Handen B, Laymon C, et al. Weight Loss and Alzheimer's Disease in Down Syndrome. Journal of Alzheimer's disease : JAD. 2023;91(3):1215-27.

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